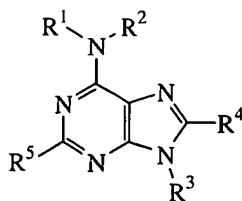


WHAT IS CLAIMED IS:

1. A method for producing a substituted purine compound of the formula:

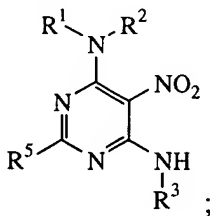


wherein

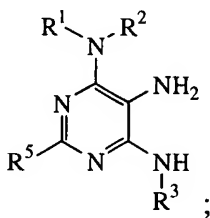
- R^1 is a solid support, hydrogen, alkyl, cycloalkyl, or aryl;
 R^2 is alkyl, cycloalkyl, aryl, or a nitrogen protecting group;
 R^3 is hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group;
 R^4 is hydrogen, alkyl, aryl, or $-NR^6R^7$, where each of R^6 and R^7 is independently hydrogen, alkyl, aryl, or cycloalkyl; and
 R^5 is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy, thioalkyl, thioaryl, or $-NR^8R^9$, where each of R^8 and R^9 is independently hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or R^8 and R^9 together with the nitrogen atom to which they are attached to form heterocyclyl;

said method comprising:

- (a) contacting a 5-nitropyrimidine compound of the formula:



with a reducing agent to produce a 4,5,6-triaminopyrimidine of the formula:



and

20 (b) forming a purine ring by contacting the 4,5,6-triaminopyrimidine with a
21 cyclizing agent to produce the substituted purine.

1 2. The method of Claim 1, wherein R¹ is a solid support.

1 3. The method of Claim 2, wherein R² is a nitrogen protecting group.

1 4. The method of Claim 2, wherein the reducing agent is selected from the
2 group consisting of:

3 (a) CrX₂, wherein each X is independently halide, and

4 (b) a mixture of 1,1'-dialkyl-4,4'-bipyridinium dihalide and a thiosulfate
5 compound.

1 5. The method of Claim 4, wherein the nitro reducing step (a) comprises a
2 presence of a protic solvent.

1 6. The method of Claim 4, wherein the 4,5,6-triaminopyrimidine produced in
2 said step (a) is substantially free of inorganic salts.

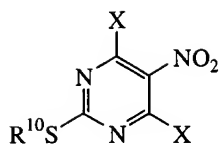
1 7. The method of Claim 4, wherein substantially all of the solid support-
2 bound pyrimidine ring remains bound to the solid support during said nitro group reducing
3 step (a).

1 8. The method of Claim 2 further comprising cleaving the substituted purine
2 from the solid support to produce the purine compound where R¹ is hydrogen.

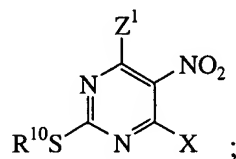
1 9. The method of Claim 1, wherein the cyclizing agent is an orthoester, an
2 acyl anhydride, an acyl halide, a mixture of isothiocyanate and an oxidizing agent, a mixture
3 isocyanate and an oxidizing agent, or a mixture of an aldehyde and an oxidizing agent.

1 10. The method of Claim 1, wherein the 5-nitropyrimidine compound is
2 produced by steps comprising:

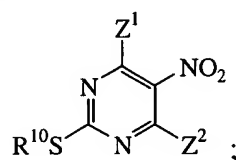
3 (a) contacting a 4,6-dihalo-5-nitro-2-thioether pyrimidine of the formula:



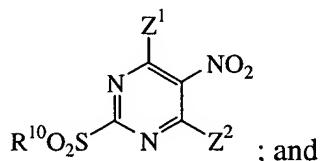
with a first amine compound of the formula Z^1H to produce a 6-aminopyrimidine of the formula:



(b) contacting the 6-aminopyrimidine with a second amine compound of the formula Z^2H to produce a 4,6-diaminopyrimidine of the formula:



(c) contacting the 4,6-diamino pyrimidine with an oxidizing agent to produce a 2-sulfonylpyrimidine of the formula:



(d) contacting the 2-sulfonylpyrimidine with a nucleophile of the formula $\text{R}^5\text{-M}$ to produce the 5-nitropyrimidine compound,
wherein

one of Z^1 and Z^2 is $-\text{NR}^1\text{R}^2$ and the other is $-\text{NHR}^3$;

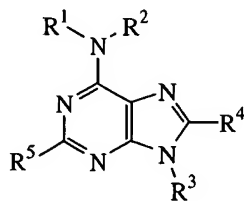
R^1 , R^2 , R^3 , and R^5 are those defined in Claim 1;

R^{10} is alkyl, cycloalkyl, or aryl;

M is hydrogen, metal, or a metal complex; and

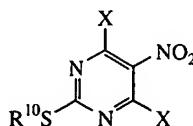
each X is independently halide.

11. A method for producing a substituted purine of the formula:

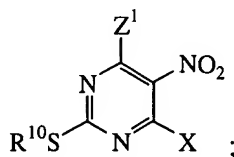


said method comprising:

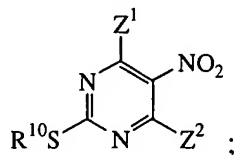
(a) contacting a 4,6-dihalo-5-nitro-2-thioether pyrimidine of the formula:



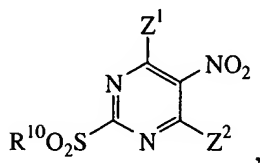
with a first amine compound of the formula Z^1H to produce a 6-aminopyrimidine of the formula:



(b) contacting the 6-aminopyrimidine with a second amine compound of the formula Z^2H to produce a 4,6-diaminopyrimidine of the formula:

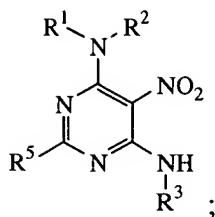


(c) contacting the 4,6-diaminopyrimidine with an oxidizing agent to produce a 2-sulfonylpyrimidine of the formula:

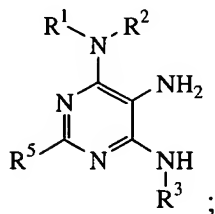


wherein one of Z^1 and Z^2 is $-NR^1R^2$ and the other is $-NHR^3$;

(d) contacting the 2-sulfonylpyrimidine with a nucleophilic compound of the formula R^5-M to produce a 5-nitropyrimidine of the formula:



(e) contacting the 5-nitropyrimidine with a reducing agent to produce a 4,5,6-triaminopyrimidine of the formula:



and

(f) contacting the 4,5,6-triaminopyrimidine with a cyclizing agent to produce the library of substituted purines,

wherein

M is hydrogen, a metal or a metal complex;

R¹ is hydrogen, alkyl, cycloalkyl, aryl, or a solid support;

R² is alkyl, cycloalkyl, or aryl;

R³ is hydrogen, alkyl, cycloalkyl, or aryl;

R⁴ is hydrogen, alkyl, aryl, or -NR⁶R⁷, where each of R⁶ and R⁷ is independently hydrogen, alkyl, aryl, or cycloalkyl; and

R⁵ is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy, thioalkyl, thioaryl, or -NR⁸R⁹, where each of R⁸ and R⁹ is independently hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or R⁸ and R⁹ together with the nitrogen atom to which they are attached to form heterocyclyl.

12. The method of Claim 11, said method is used to produce a combinatorial library of substituted purine compounds.

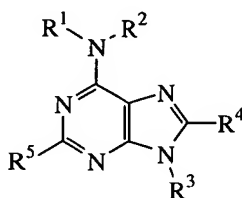
13. The method of Claim 12, wherein R¹ is a solid support and wherein the library of substituted purines is a library of solid support-bound substituted purines.

1 14. The method of Claim 13, wherein each purine compound in the
2 combinatorial library is spatially separated.

1 15. The method of Claim 13, wherein the combinatorial library is formed on a
2 plurality of particles, each particle having a surface coating of purine molecules of the same
3 substituents.

1 16. The method of Claim 13 further comprising cleaving the solid support-
2 bound substituted purines from the solid support to produce a library of non-solid support-bound
3 substituted purines.

1 17. A combinatorial library of purines, wherein each purine in the library is of
2 the formula:



3
4 wherein

5 R¹ is a solid support, hydrogen, alkyl, cycloalkyl, or aryl;

6 R² is alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

7 R³ is hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group;

8 R⁴ is hydrogen, alkyl, aryl, or -NR⁶R⁷, where each of R⁶ and R⁷ is independently
9 hydrogen, alkyl, aryl, or cycloalkyl; and

10 R⁵ is alkyl, alkoxy, alkenyl, alkynyl, aryl, aryloxy, cycloalkyl, cycloalkoxy,
11 thioalkyl, thioaryl, or -NR⁸R⁹, where each of R⁸ and R⁹ is independently
12 hydrogen, alkyl, cycloalkyl, aryl, or a nitrogen protecting group, or R⁸ and
13 R⁹ together with the nitrogen atom to which they are attached to form
14 heterocyclyl.

1 18. The combinatorial library of Claim 17, wherein R¹ is a solid support.

1 19. A method for reducing a nitro substituent on a pyrimidine ring which is
2 covalently attached to a solid support, wherein the pyrimidine ring is optionally substituted with
3 one, two, or three independent non-hydrogen substituents, said method comprising:

4 (a) reducing the nitro functional group to an amino functional group by
5 contacting the solid support-bound pyrimidine compound with chromium
6 dihalide to produce a reaction mixture comprising a solid support-bound
7 amino pyrimidine compound; and

8 (b) removing the solid support-bound amino pyrimidine compound from the
9 reaction mixture,

10 wherein the solid support-bound amino pyrimidine compound that is removed from the reaction
11 mixture is substantially free of inorganic salts.

1 20. The method of Claim 19, wherein substantially all of the solid support-
2 bound pyrimidine ring remains covalently bound to the solid support during said nitro group
3 reducing step (a).

1 21. The method of Claim 19, wherein the reaction mixture further comprises a
2 protic solvent.

1 22. The method of Claim 19, wherein the chromium dihalide is chromium
2 dichloride.